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ABSTRACT

A study investigated the learning impact of audio, visual, and audiovisual information channels in televised messages among preschool children. The messages consisted of a half-hour videotape of "Sesame Street" episodes (presented to 48 subjects), and a videotape of an intact "Mister Roger's Neighborhood" program (presented to 50 subjects). Subjects viewed the videotapes alone in a room that simulated natural viewing conditions, with comfortable furniture, indirect lighting, and the presence of toys and books as alternative activities to viewing. During the program, subjects were observed through a one-way window. Immediately after the tapes ended, the experimenter administered a learning questionnaire, which was broken down in terms of the mode by which the information necessary to answer the question was presented. Each subject viewed all conditions and responded to three separate sets of questions, dealing with information presented on the audio track, the visual track, and both tracks congruently. Results of the questionnaire indicated that audiovisual messages and visual messages were recollected significantly better than audio ones. There were no differences between audiovisual and visual messages, however. The results supported a theory regarding the visual nature of children's cognitive processing abilities, and questioned the necessity of providing verbal labels for visual information (HTH)

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The Impact of Information Channel on
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Television Viewers

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INTRODUCTION

It is often assumed that message redundancy, or the repetitive presentation of information, should facilitate learning. This redundancy is sometimes achieved through multi-trial learning in which the original message is simply repeated over time. In media related research, however, redundancy is often achieved through the simultaneous transmission of the information by different communication modes. A considerable amount of research has been generated, for instance, that assesses the relative merits of word-picture message combinations over single mode presentations in promoting learning, both among children and adults. The bulk of this research, however, has employed static visual stimuli, such as line drawings (e.g., Dilley and Paivio, 1968; Rohwer, 1970; Peng and Levin, 1979), making generalization to the more complex displays involved in televised instruction questionable. Two exceptions are a study by Friedlander, et al. (1974) involving the influence of televised stimuli on recall, and another summarized by Rohwer (1970).

As will be seen below, the relative advantages of the audio and visual message modes is a controversial issue, at least for learning purposes among young children. It is also not a trivial issue: Anderson, et al. (1981) analyzed 15 different Sesame Street programs and found that only 14% of total program time was given to information presented jointly. Consequently, an investigation of this topic using televised messages is clearly warranted. The present study, then, addresses the general issue of audio/visual message presentation modes in a televised program and its impact on learning among preschool viewers of "Sesame Street," and Misterogers's Neighborhood.

Friedlander, et al. (1974) compared recall performance on questions for which the information available to answer the question was presented both auditorally and visually, visually only, or auditorally only. Recall performance was significantly higher on the audio-visual questions than for the audio only questions. No significant differences obtained between audio-visual and visual only questions, but the authors asserted that this was most likely due to the small number of questions in the visual-only category.

Peng and Levin (1979) found that story-relevant pictures significantly improved second graders' recall of stories, both immediately after hearing the stories as well as three days later.

Paivio (1963; 1965) and Paivio and Yuille (1966) demonstrated that words for which the referents are concrete objects, such as chair or dog, enhance paired-associate learning more than words for which the referents are abstract ideas, such as peace or freedom. The rationale for this finding is that concrete symbols more easily evoke mental pictures than do less concrete symbols, and that these mental pictures, or images, in turn may mediate learning. While these findings are consistent across age groups, there is theoretical reason to believe that iconicity may be particularly important when the learners are young children. Bruner (1964) has suggested that the young child's thinking is characterized by predominantly iconic modes of representation.

It follows, then, that if concrete words are superior to abstract ones in enhancing learning, because of their imagery-evoking potential, pictures of objects would be even better. Dilley and Paivio (1968) tested this idea by having children aged three and a half to seven and a half learn a series of paired associate items. There were four learning conditions. In the first, both stimulus and response members of the pair were pictures. In the second, the stimulus member was a picture while the response member was a

word. The third and fourth conditions involved word-word and word-picture combinations respectively. Following the initial learning trials in which both members of the pair were presented, the stimulus members only were shown and the subjects were asked to verbally describe the response member of the pair.

Results indicated that the most successful learning condition was the one in which the first member of the pair was indeed a picture but in which the second member was a word. The authors' explanation is that the response required of the children was a verbal one, and that they, more than adults, have difficulty spontaneously decoding a mental image into a word (Ducharme and Fraisse, 1965).

In his review of research in this area, Rohwer describes a secondary analysis of Dilley and Paivio's data. He found a negative linear trend between age and the benefits derived from having combined word-picture stimuli rather than pictures alone. Thus, the youngest children benefitted the most from having the verbal labels paired with the images. Furthermore, among the nursery school subjects, there were no significant differences in learning between picture only stimuli and word only stimuli. .

In another of his studies described in Rohwer (1970), the author examined older children (kindergarten, first grade and third grade) learning paired associates from television. All subjects learned the most from the joint message presentation on both tracks, and also benefitted more from pictures alone than from words alone. Again, Rohwer found that the youngest children benefitted the most from the joint presentation condition.

To summarize, these studies suggest for young children a distinction between the learning process, which may be aided by imagery-inducing stimuli, such as pictures; and the retrieval process which is often verbal in nature and may be aided by the provision of words.

These results further suggest that television, like other pictorial media, would facilitate learning in young children as a result of its inherent iconic mode of representation. However, when the learning measures employed require verbal responses, then learning - or at least retrieval of what has been learned - may be facilitated when these pictures are accompanied by words.

A separate but related issue involves the relative efficacy of the audio and visual tracks alone: if the information is presented via one mode only, which mode should be superior for learning purposes among preschool aged children?

The preceding discussion suggests that young children may not spontaneously attach verbal labels to visual stimuli, thus making recall difficult. Wackman and Wartella (1977) note that, for preschool aged children, "The failure to produce verbal mediators suggests that learning from visual stimuli may be more difficult than learning from auditory stimuli" (p. 213). Why should this be so in spite of the fact that the cognitive activity of young children has been described as relatively perception-bound (e.g., Ward and Wackman, 1973; Flavell, 1963) or iconic (Bruner, 1964)? The answer lies in the nature of the responses required of subjects to assess learning. In the studies cited above, the responses required of the children are verbal in nature. While young children tend to perform more successfully on tasks that do not require verbalization (Welch, 1980; Brown, 1975), it can be argued that we live in an essentially verbal world and that verbal learning performance is more important in the long run. This discussion suggests that the auditory track will be more influential in promoting verbal learning performance among young children.

There is a further, nontheoretical reason why the auditory track might have a greater impact on learning. Presumably, in order to gain the visual message, one must be watching the television screen. One can still obtain the auditory message, however, while carrying out other activities.

On the other hand, there is also other research evidence suggesting that visual-only presentations may be far more successful in aiding learning in young children than audio-only presentations, and in fact may be equal to combined audio-visual presentations. Hayes and Birnbaum (1980) asked preschool subjects recognition questions concerning information that had been presented on the visual track alone, the audio track alone, or both tracks congruently.. Subjects exposed to the audio condition were generally unable to answer the questions successfully, while those exposed to the visual only condition were as successful as those in the congruent condition. In this study, the single channel conditions contained inconsistent information on the alternate channel. Subjects saw one cartoon on the visual track and heard a completely different one with different characters on the soundtrack. In these inconsistent conditions, subjects apparently ignored the audio track and focused entirely on the visual track, so much so that most of them were unaware of the discrepancy.

These findings suggest that young children do not attend strongly to the audio track and therefore will be more influenced by the information presented on the visual track. Such behavior makes sense if Bruner is correct about the iconic quality of young children's information processing.

To try and summarize these somewhat disparate findings the available research evidence consistently concludes that joint audiovisual presentations, ones in which there are visual tags for the words presented on the soundtrack,

will be learned significantly better by young children than presentations without such visual tags. The relative efficacy of audiovisual presentations over strictly visual ones is not as clear cut. While most of the research points to the superiority of joint presentations, at least one study concludes that there are no differences. Unfortunately, the theoretical literature on the cognitive abilities of young children being imagery-oriented (Bruner, 1964; Flavell, 1963) can be used to support either position. And, finally, with regard to the relative merits of visual-only versus audio-only presentations, the evidence is again conflicting. Those supporting the superiority of visual information tend to rely on the theoretical literature regarding the iconic quality of children's cognitions, while those supporting the superiority of audio information tend to refer to the same literature, but from a deficit perspective: the idea that young children do not remember things verbally, and do not spontaneously associate remembered images with their verbal labels; and therefore, when the learning measure involves verbal recall, are most helped when the verbal labels are provided for them.

The present study will assess the relative merit for verbal learning purposes of audio visual, visual, and audio modes of televised information presentation among preschool aged viewers.

PROCEDURES

Stimulus Materials

The stimulus materials consisted of a black and white videotape of 12 segments of "Sesame Street" which lasted approximately 30 minutes and a black and white videotape of a "Misterogers Neighborhood" program. Although the Sesame Street tape was originally put together by Children's Television Workshop for experimental purposes, all of the segments had been aired at

some point prior to this study. A second Sesame Street tape was prepared in which the position of segments was reversed, except for the opening, to control for order effects on learning. The Misterogers's program was taped off the air.

Sample

The sample of Sesame Street viewers consisted of 25 males and 23 females, ranging in age from four years, zero months, to six years, zero months. All subjects were Caucasian. The Misterogers's Neighborhood sample consisted of 19 males and 31 females ranging in age from three years, seven months to six years, zero months. In spite of their nonrepresentativeness, there is no reason to expect that either of these samples should differ from the population as a whole with respect to the questions addressed by this study.

Experimental Procedures

Subjects viewed the videotape alone in a room that simulated natural viewing conditions, with comfortable furniture, indirect lighting, and the presence of toys and books as alternative activities to viewing. During the program, subjects were observed through a one-way window. Immediately after the tape ended, the experimenter entered the room and administered the learning questionnaire.

Information Modes

The learning questionnaire was broken down in terms of the mode by which the information necessary to answer the question was presented.

Auditory-visual questions were those in which the information necessary to answer the question correctly was presented on both tracks of the videotape. For example, one of the Sesame Street segments involved the "Mr. Hooper" character who was trying to decide which of several boxes to put a beach ball in. As he verbally described the contents of each box, the camera simultaneously did a close-up of these contents.

The audio-visual score for each subject represented the mean of the scores for audio-visual questions.

Visual questions were those in which the information necessary to answer the question correctly was presented visually only. An example was a segment on the Sesame Street tape in which several children were attempting to put together a large puzzle shaped like the letter b, during which time the soundtrack consisted of music.

The visual score for each subject represented the mean of the scores for all visual questions.

Auditory questions were those in which the information necessary to answer the question was presented on the soundtrack only. For example, a narrative on Misterogers concerned why one of the characters didn't like or understand the way another character talked. While the characters were depicted during this narrative, the substance of their conversation was not. The auditory score for each subject represented the mean of the scores for all auditory questions.

Each subject, therefore, viewed all conditions and responded to three separate sets of questions: those dealing with information that had been presented on the audio track, the visual track, and both tracks congruently. The assumption is being made that these sets of questions are comparable in relevant characteristics. Such an assumption seems warranted in that they all reflect information presented on the same program and generally are not biased towards particular segments within each program. Furthermore, all questions were pretested for difficulty and comprehensibility on six pre-school aged children. And, finally, the comparisons are being performed on two independent and very different sets of stimulus materials. If our findings are consistent for both sets, we can argue against their being the result of an individual program's idiosyncratic style.

RESULTS

The differences between groups on learning were examined with t-tests for differences between dependent means on the learning scores for each condition. Since multiple (6) t-tests were actually performed, the probability of achieving statistical significance is increased. To guard against this phenomenon, the more stringent alpha level of .01 was utilized over the more conventional .05 level.

The results of these tests for Sesame Street can be seen in Table 1. With regard to the expected differences between audio-visual and audio modes, previous research and theoretical work indicated that the audio-visual condition would be superior. Consequently, a one tailed probability level of the t value was utilized. As can be seen in Table 1, the differences in learning scores between these two conditions are significant at the .001 level with audio-visual scores indeed being superior.

The review of the literature provided somewhat conflicting expectations for the differences between audio visual and visual modes and between visual and audio modes. As a result, two tailed probability estimates were used to assess the difference between conditions in these cases. Table 1 shows that audio-visual scores and visual scores were not significantly different from one another, while visual scores were significantly superior to audio scores.

Table 2 provides the results for the t-tests on the Misterogers scores. Again, one-tailed probability estimates were used for the audio-visual/audio comparison, and two-tailed probability estimates were used for the audio-visual/visual comparison and the visual/audio comparison. The results are completely consistent with those obtained for Sesame Street. Audio-visual messages were recalled significantly better than audio messages, but nonsignificantly differently from visual messages. In fact, the audio-visual

and visual scores are almost identical. Likewise, visual messages were recalled significantly better than audio messages.

Discussion

To summarize these results, both Sesame Street and Mistergoers! subjects recalled audio visual and visual information equally well and significantly better than audio information. These results are quite similar to those obtained by Hayes and Birnbaum (1980) who found that preschool children tended to remember what was on the video track regardless of what was on the audio track.

These findings are at odds with the literature suggesting that young children need to be provided with verbal labels in order to successfully recall visual information verbally. Hayes and Birnbaum used recognition questions which did not require that the subjects provide their own verbal labels. The present findings are especially noteworthy in that they replicate those of Hayes and Birnbaum but with a learning task that required independent verbalization by the subjects.

These results are consistent with theoretical descriptions of the cognitive processing abilities of young children (Bruner, 1964; Flavell, 1963). If young children are inclined to process information iconically, it makes sense that iconic stimuli will be more influential in that process.

If correct, then findings suggest a deemphasis, at least for learning purposes, on information presented auditorally. Anecdotal observation of children's television programming suggests that the audio channel alone is used extensively to transmit the informational content of the program narrative, while the video track is used often to carry referents of the plot line but not the plot itself. Future research efforts ought to be directed at documenting the channel emphasis with regard to informational content across a variety of programs that are oriented towards teaching young children.

A number of qualifications should be raised with respect to aspects of the present findings, however. First, this paper provides evidence that subjects perform equally whether they have to provide their own verbal labels (visual condition) or whether labels are provided for them (audio visual condition). It seems reasonable that their ability to do so would hinge in part on the nature of the labels. For example, young children should be able to come up with familiar, simple words more easily than unfamiliar or difficult ones. There certainly may be subject matter, therefore, that young children would learn better with labels provided than without.

Second, the present results regarding the ineffectuality of the audio channel hold only for the learning of informational content. A fairly extensive body of research has been accumulated regarding the importance of the audio track in influencing young children's visual attention patterns (e.g., Anderson and Levin, 1976).

Finally, the present methodology may be somewhat deficient to make true comparisons. The utilization of the t test procedure was based on the assumption that the questions in the different conditions were indeed comparable. It is possible, however, that the sets of questions did differ systematically in a consistent manner across both programs, even though all of the questions were pretested for difficulty and comprehensibility. To determine if this is the case, a non-repeated measures design could be employed in which the informational content remains the same across conditions and only the channel varies.

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Table 1

T-Tests for Differences between Recall Means by Sesame Street Viewers for Audio-Visual, Visual and Audio Questions.

	<u>mean</u>	<u>s.d.</u>	<u>t value</u>	<u>df</u>	<u>1 tailed prob.</u>
Audio-Visual	1.57	.50	4.45	44	< .001
Audio	1.19	.45			
	<u>mean</u>	<u>s.d.</u>	<u>t value</u>	<u>df</u>	<u>2 tailed prob.</u>
Audio-Visual	1.57	.52	1.24	44	n.s.
Visual	1.46	.40			
Visual	1.45,	.41	3.72	42	< .001
Audio	1.19	.45			

Table 2

T-Tests for Differences between Recall Means by Misteroger's Neighborhood Viewers for Audio-Visual, Visual and Audio Questions

	<u>Mean</u>	<u>s.d.</u>	<u>t value</u>	<u>df</u>	<u>1 tailed prob.</u>
Audio-Visual	1.73	.51	8.76	39	< .001
Audio	1.06	.46			
	<u>Mean</u>	<u>s.d.</u>	<u>t value</u>	<u>df</u>	<u>2 tailed prob.</u>
Audio-Visual	1.73	.51	.07	43	n.s.
Visual	1.72	.38			
Visual	1.71	.39	11.39	40	< .001
Audio	1.07	.46			